

Applicant: Kari Holopainen et al.
Application No.: 10/070,024
In response to Office action dated Sept. 15, 2004
Amendment dated Dec. 15, 2004

Claim Listing

1-13. (cancelled)

14. (currently amended) A calender having a plurality of calender rolls arranged one upon the other, and including a top calender roll and a bottom calender roll, and defining in operation at least one profiling nip for profiling a fibrous web that is being calendered, at least one of the calender rolls defining the profiling nip being a shoe roll comprising an outer shell and at least one row of internal shell-loading shoe means for profiling the shell, the nip and the fibrous web as well as for controlling contact in the nip, the improvement comprising:

the shoe roll is located between the top and bottom calender rolls;

the shoe roll outer shell is of continuous-fibre reinforced composite material, the fiber orientation being such that the composite material outer shell is more rigid in the circumferential direction than in the axial direction; and

the at least one row of internal shell-loading shoe means of the shoe roll is arranged parallel to a nip defined against the shoe roll.

15. (previously presented) The calender of claim 14 wherein the plurality of calender rolls further comprises a first press roll below the upper roll, and a first intermediate roll below the first press roll, and a second press roll above the bottom calender roll, and a second intermediate roll above the second press roll, and wherein both the first intermediate roll and the second intermediate roll are shoe rolls.

16. (previously presented) The calender of claim 14 wherein there are a plurality of rows of internal shell-loading shoe means within the shoe roll, the rows being uniformly spaced with respect to one another in the circumferential direction of the composite material outer shell.

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17. (previously presented) The calender of claim 14 wherein the top calender roll is a shoe roll.

18. (previously presented) The calender of claim 14 wherein the the bottom calender roll is a shoe roll.

19. (cancelled)

20. (currently amended) The calender of claim ~~[[19]]~~ 14, wherein the continuous-fibre reinforced composite material ~~[[is]]~~ includes plastic or epoxy reinforced by glass fibres or carbon fibres, and that in order to provide a shell which is more rigid in the circumferential direction in relation to the axial direction of the shoe roll, orientation of the fibres of the composite material has been accomplished such that a major proportion of the fibres of the composite material of the shell of the shoe roll are directed at an angle of over 45° with respect to the axis of the shoe roll.

21. (previously presented) The calender of claim 20, wherein the angle is in the range of 70°–90°.

22. (previously presented) The calender of claim 14 wherein the shoe roll is a hydraulically zone-controlled roll, the composite shell of which is supported from a non-rotating central shaft of the shoe roll by means of hydrostatic loading arrangements which transfer the nip force directed at the composite shell rotating around the central shaft so as to be carried by the central shaft.

23. (previously presented) The calender of claim 22 wherein the hydrostatic loading arrangements comprise rows of loading shoes.

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24. (previously presented) The calender of claim 14 wherein the calender has at least one intermediate roll positioned between the calender top roll and the calender bottom roll, and wherein at least one of the top roll, the at least one intermediate roll, and the bottom roll is a shoe roll.

25. (previously presented) The calender of claim 14 wherein in calender operation, the shoe roll is separable from a nip forming contact with a press roll or another shoe roll.

26. (previously presented) The calender of claim 14 wherein the plurality of calender rolls comprises two stacks of three rolls, one of the two stacks defining an upper stack the top roll being the uppermost roll of the upper stack, and the other of the two stacks defining a lower stack, the lower roll being the lowermost roll of the lower stack, the upper stack being placed upon the lower stack such that between the two stacks there remains a space which is defined by a bottom lower roll of the upper stack and by [[a top]] an upper roll of the lower stack, the shoe roll being one of the upper stack lower roll and the lower stack upper roll, wherein the bottom roll of the upper stack and the top roll of the lower stack can be separated from contact with rolls of their own roll stack into nip contact with each other.

27. (previously presented) The calender of claim 26 wherein the bottom roll of the upper stack and the top roll of the lower stack are shoe rolls having roll shells, and at least the bottom roll of the upper roll stack and the top roll of the lower roll stack are fixedly mounted on a calender frame such that their shells can be displaced in the direction of the roll stack with respect to roll supports of the rolls.

28. (previously presented) The calender of claim 27 wherein at least the bottom roll of the upper roll stack and the top roll of the lower roll stack are provided with loading members located inside their roll shells.

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29. (currently amended) A calender for treatment of a fibrous web passing therethrough, the calender comprising:
- a frame;
 - a top roll mounted to the frame;
 - a first press roll mounted to the frame beneath the top roll;
 - a first intermediate roll mounted to the frame beneath the first press roll, wherein the top roll, the first press roll, and the first intermediate roll comprise a first roll stack;
 - a second intermediate roll mounted to the frame beneath the first intermediate roll;
 - a second press roll mounted to the frame beneath the second intermediate roll;
 - a bottom roll mounted to the frame beneath the second press roll, wherein the second intermediate roll, the second press roll, and the bottom roll comprise a second roll stack; and
- wherein the first intermediate roll and the second intermediate roll are shoe rolls, each having outer shells of continuous-fibre reinforced composite material, the fiber orientation being such that the composite material outer shell is more rigid in the circumferential direction than in the axial direction, and each having at least one row of internal shell-loading shoe means, the shoe means being operable to load the first intermediate roll against the first press roll and the second intermediate roll against the second press roll, or alternatively to load the first intermediate roll against the second intermediate roll.
30. (cancelled)

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31. (currently amended) The calender of claim 29 wherein the first intermediate roll and the second intermediate roll are fixedly mounted on the frame such that their shells can be displaced in the direction of the first roll stack or the second roll stack respectively with respect to roll supports of the rolls.

32. (previously presented) The calender of claim 29 wherein each shoe roll outer shell is of continuous-fibre reinforced composite material.

33. (new) A multi-roll calender for calendering a fibrous paper web, the calender comprising a plurality of rolls arranged one upon the other and defining in operation at least one profiling nip for profiling the fibrous paper web, wherein at least one intermediate calender roll located between a top calender roll and a bottom calender roll of the multi-roll calender is a shoe roll, which defines said at least one profiling nip together with another calender roll, the at least one shoe roll comprising a non-rotating central shaft, a shell rotating around the central shaft, and at least one row of internal shell-loading shoes being supported on the central shaft so that one row is arranged in the plane of the at least one profiling nip wherein at least two superimposed intermediate calender rolls are shoe rolls having a shell of a fibre reinforced composite material the fiber orientation being such that the composite shell is more rigid in the circumferential direction than in the axial direction, said shell being displaceable in relation to the central shaft in order to separate the two superimposed intermediate shoe rolls from a nip forming contact with another calender roll or another shoe roll in calender operation.